

Statement of Work and QA Requirements for Analysis of Tritium, Stable Carbon Isotope Ratio of DIC, and Stable Isotope Ratios of Dissolved Gases in Water Samples.

Synopsis: Samples of ground water will be provided for tritium analysis and isotopic analyses of dissolved inorganic carbon (DIC) and dissolved gases. The vendor shall not be required to determine the concentration of inorganic carbon or dissolved gases in the samples. The isotope analyses are intended to provide information age of ground water and the carbon cycle in the system. The measurements will be for ^3H , $\delta^{13}\text{C}$ of dissolved inorganic carbon, the $\delta^{13}\text{C}$ value of C1-C5 gases, and the $\delta^2\text{H}$ of hydrogen in methane.

EPA Responsibilities: Samples will be provided from ground-water monitoring wells located around Pavillion, WY. The wells will be sampled during April 2012. The vendor shall be notified at least one week in advance of the sample collection activities. Duplicate samples will be collected in 10% of the wells, ~~or as otherwise indicated in approved QAPPs~~. A total of up to 10 samples will be submitted for ^3H , $\delta^{13}\text{C}$ of dissolved inorganic carbon, and a total of up to 10 samples are planned for dissolved gas analysis. In addition to field duplicates, it is expected that the vendor shall select one sample for a laboratory duplicate analysis in each submitted set to fulfill QA/QC requirements. This sample shall to be from our submitted sample sets and not from another site or sample queue.

The samples for tritium analysis will be collected in 500 mL plastic bottles (unfiltered, unpreserved). The inorganic carbon samples will be collected into 60 mL plastic bottles (filtered, unpreserved); the dissolved gas samples will be sampled into 1 L plastic bottles provided by Isotech Laboratories. The bottles will be filled with ground water and those for dissolved gas analysis will be preserved with a caplet of benzalkonium chloride. It is expected that the concentration of DIC and dissolved gases will be high enough in the samples so that these volumes will be adequate for the analyses. For the dissolved gas samples, the bottles will be transported so that the aqueous solution will be on top of the bottle closure, i.e., the bottles will be transported upside down. All samples will be transported on ice.

Contractor Responsibilities: The vendor shall determine the stable carbon isotope ratio of DIC and dissolved gases and hydrogen in methane in the water samples as described above. Analyses of the laboratory duplicates shall agree within 1 permil ^{13}C and within 3 permil ^2H , or less. The measured value of the stable carbon and hydrogen isotope ratio in calibration standards shall be within 0.5 permil or less and 3 permil or less, respectively, of the nominal value in the calibration standards. Samples shall be analyzed using Isotech SOP112v2, *$^{13}\text{C}/^{12}\text{C}$ Determination of DIC*, 05/26/2011, Isotech SOP100v0, *Offline Hydrocarbon Gas Preparation System, Gamma Bench*, 12/27/2010, Isotech SOP101v0 *Offline Gas Preparation System, Alpha Bench*, 10/21/2003, Isotech SOP103v0, *Delta Plus Mass Spectrometer, Dual Inlet Analysis of δD* , 2/22/2010, Isotech SOP104, *Delta S Mass Spectrometer, Dual Inlet Analysis of $\delta^{13}\text{C}$* , and Isotech SOP-117Rev0, *Low Level Tritium Analysis of Water*. QA/QC requirements are summarized in the attached tables.

Acceptance Criteria: The contractor's results shall be considered acceptable if samples were analyzed using SOPs as listed above, the QA/QC requirements as summarized in the attached Tables are met, and deliverables listed below are met.

Deliverables: Isotech Laboratories shall submit: 1) preliminary data report at completion of analysis including tabulation of final results and list of SOPs used (title and SOP #); and 2) full data packages. The initial data report shall be reported to Rick Wilkin via email at wilkin.rick@epa.gov within five weeks of

the receipt of the samples. Full data packages should be received within 30 days of issuing final validated results and shall be provided on CD (Microsoft Excell Format) for all sample analyses to allow for reconstruction of analysis; Chain-of-Custody forms, calibration data, QA/QC data, raw data, data reduction, data qualifiers, deviations from method requirements, deviations from QC acceptance criteria, and these deviations' impact to reported results. The electronic deliverables can take the form of MS Excel spreadsheets or pdf files of data reports and raw data. The full data packages shall be copied to the GWERD QA Manager, Steve Vandegrift, email vandegrift.steve@epa.gov.

Period of Performance: 6 months from receipt of samples

Technical Point of Contact: Dr. Rick Wilkin, 580-436-8874, E-mail: wilkin.rick@epa.gov, Alternate point-of-contact, Steve Vandegrift, 580-436-8684

Table 1. Isotech Laboratory QA/QC Requirements for $\delta^{13}\text{C}$ of DIC (Dissolved Inorganic Carbon)

QC Type	Performance Criteria	Frequency
Mass Spec Calibration Check	Difference of calibrated/true $\leq 0.5\%$	One @ beginning of day, and one after samples analyzed
Mass Spec Zero Enrichment Check	0 +/- 0.1 ‰	Once a day
Lab Duplicates	$\leq 1\%$	1 per every 5 samples**

*Working standard

standards calibrated against IAEA (International Atomic Energy Agency) standard LSVEC and NBS-19; referenced to $\delta^{13}\text{C}$ of the Pee Dee belemnite (NIST material).

**If < 5 samples are submitted, run a duplicate regardless of total number.

Corrective Actions: If any samples are affected by failure of a QC sample to meet its performance criteria, the problem shall be corrected and samples will be re-analyzed. If re-analysis is not possible (such as lack of sample volume), the data will be qualified with a determination as to impact on the sample data.

QC Type	Performance Criteria	Frequency
Mass Spec Calibration Check	Difference of calibrated/true $\leq 0.5\text{‰}$ for $\delta^{13}\text{C}$ and $\leq 3\text{‰}$ for δD	One @ beginning of day and after samples are analyzed for $\delta^{13}\text{C}$ *; one @ beginning of day and every tenth sample for δD **
Mass Spec Zero Enrichment Check	0 +/- 0.1 ‰ for $\delta^{13}\text{C}$ and 0 +/- 1 ‰ for δD	Once a day for $\delta^{13}\text{C}$ and every tenth sample for δD
Lab Duplicates	$\leq 1\text{‰}$ for $\delta^{13}\text{C}$ and $\leq 3\text{‰}$ for δD	1 per every 10 samples***
Preparation System Check/Reference Standards	$\leq 1\text{‰}$ for $\delta^{13}\text{C}$ and $\leq 3\text{‰}$ for δD	One per every 10 samples

Table 2. Isotech Laboratory QA/QC Requirements for $\delta^{13}\text{C}$ of Dissolved Gases (C1-C5) and δD of Dissolved Methane.

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*Working standards calibrated against IAEA (International Atomic Energy Agency) standard LSVEC and NBS-19; referenced to $\delta^{13}\text{C}$ of the Peedee belemnite (NIST material).

**Working standards calibrated against VSMOW, SLAP, and GISP; referenced to VSMOW.

***If < 10 samples are submitted, run a duplicate regardless of total number.

Corrective Actions: If any samples are affected by failure of a QC sample to meet its performance criteria, the

problem shall be corrected and samples will be re-analyzed. If re-analysis is not possible (such as lack of sample volume), the data will be qualified with a determination as to impact on the sample data.

QC Type	Performance Criteria	Frequency
Calibration Check	Accuracy criteria based on 1 sigma limits of existing data	Dead water blank in every set or minimum of 1 per 12 samples; calibrated with NIST 4361C, 1 per every 12 samples
Lab Duplicates	Precision based on 1 sigma limits of existing data	1 per every 10 samples
Preparation System Check/Reference Standards	Accuracy criteria based on 1 sigma limits of existing data	One per every 12 samples, checks against prepared dilutions of NIST 4361C

Table 3. Isotech Laboratory QA/QC Requirements for Tritium.

Information from Isotech Quality Assurance Plan.